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TASK PERFORMANCE, ATTENTION AND CLASSROOM BEHAVIOR OF SERIOUSLY DISTURBED, COMMUNICATION-IMPAIRED, "AUTISTIC"-TYPE CHILDREN UNDER CONDITIONS OF REDUCED AUDITORY INPUT*

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This study is concerned with children in special schools who are seriously emotionally disturbed, who are, for the most part, non-communicative, who are frequently described as "psychotic" and more specifically as "autistic."

There exists a growing body of literature reporting abnormal responses of "autistic" and other psychotic children to various stimuli. Bergman and Escalona (1949) were among the first researchers to report such unusual sensitivities. Since then, unusual responses to sound, sight, and smell have frequently been documented (Stroh & Buick, 1964), but responses to sound have elicited the greatest comment. For example, it has been suggested that psychotic children may be particularly sensitive to certain sounds (Clark, 1965; Wing, 1966, pp. 3-39), that they may become very distressed by particular noises of only moderate loudness (Rutter, 1968), and that they are more likely than normal children to overreact to sound or else to deny sound completely (Goldfarb, 1961).

In addition, some recent reports indicate that psychotic indviduals respond differently than normal individuals to periods of sensory deprivation. Investigations involving almost complete sensory deprivation usually produce deteriorating effects on the behavior and mental abilities of normal subjects (Bexton, Heron & Scott, 1954; Scott, Bexton, Heron & Doane, 1959). In contrast, similar procedures have produced facilitative effects on psychotic individuals (Harris, 1959; Ruff, 1966).

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Also, of possible relevance, children with neurological impairment often have difficulty in suppressing distracting background stimuli (Werner & Strauss, 1941; Eisenberg, 1964). Cerebral palsied children (who suffer from a brain injury accompanied by a motor impairment) have been found to show improvement in their performance on selected tasks under conditions of partially reduced auditory input, particularly on tasks involving memory, concentration and sustained attention (Fassler, 1970).

There are contradictory opinions as to whether or not the illness of psychotic, and particularly autistic, children is basically a neurological disorder, but there does seem to be agreement that psychotic children, like neurologically impaired children, frequently appear to be high distractible. For example, Wing and Wing (1966), among others, maintain that psychotic children are constantly at the mercy of the extraneous and irrelevant details in their surroundings, and Stroh and Buick (1964) have suggested that psychotic children often have great difficulty in responding selectively to the mass of stimuli by which they are surrounded. A large part of such stimuli involves auditory input.

Accordingly, the evidence cited above, particularly the reports that psychotic children exhibit unusual responses to auditory stimuli and also exhibit distractibility, suggests that such children might show a positive change in attention and in task performance as a result of partial reduction in auditory input. This study explores this possibility through the following hypotheses:

Under conditions of reduced auditory input, seriously disturbed, communication-impaired, "autistic"-type children will show an increase in:

1. The amount of attention exhibited in their classroom settings;

2. Their ability to attend to a series of tasks involving concentration attention and sustained activity;

3. Performance on selected tasks involving concentration, attention and sustained activity.

METHOD

Subjects

A group of 20 Ss, ranging in age from approximately 5 to 12 years, was used in this study. Ten Ss were enrolled from each of two special schools for seriously disturbed children in New York City. The group consisted of 14 males and 6 females, a distribution closely resembling the sex ratio exhibited in each of the two schools for the type of child being studied. Each of the Ss had been described by his teachers as being seriously disturbed, as being either non-communicative or showing difficulties in his ability to relate to human beings. An examination of S records revealed frequent statements indicating unusual object attachments, confusion about reality, and a seemingly excessive desire for sameness. In addition, an examination of reports from psychologists and psychiatrists indicated that most of these children had previously been described as "psychotic," "autistic," or suffering from "early infantile autism."

An individual intelligence test had been recently administered or attempted with each S. It is, however, extremely difficult to obtain a valid IQ score for tye type of child being studied in this investigation. Accordingly, psychological examiners and teachers frequently commented that a particular score was questionable for a certain child, emphasizing the fact that all Ss in this investigation were considered to be educable or higher by school officials, regardless of the actual score achieved on an IQ test.

The 20 S who participated in this investigation were selected from approximately 25 children. Five potential Ss were not included in the present study because of the inability of E, despite much effort and patience, to obtain cooperation concerning the wearing of the auditory devices.

Regarding communication skills, most Ss had been rated as verbalizing single words and/or phrases only, usually without any clear meaning. Only three Ss had been rated as using language for cognitive purposes; however, it should be noted that such use of language was on an infrequent and irregular basis. Ss were also rated for the presence of echolalia. More than half of the group showed evidence of echolalia and, in 20% of the Ss, speech was predominantly echolalic. Accordingly, it was apparent that the group showed evidence of severe language impairment, and it was evident that any meaningful test items to be administered to these children for purposes of the present project would have to depend on non-verbal responses.

Since records often contained contradictory diagnoses related to organicity, no attempt was made to categorize Ss in this area.

Audiometric screening by the staff of the Tachers College Speech and Hearing Center for 10 of the 20 Ss, and information available from the records of the remaining Ss in this investigation, revealed evidence of no appreciable hearing loss.

A summary of the S characteristics described above and some distribitive information concerning such characteristics can be found in Table 1.

Setting and Procedure

Since the major purpose of this study was to ascertain if a reduction in auditory input would result in an increase in classroom attention and an increase in attention to and performance on a series of selected tasks, the setting was

kept as natural as possible so that each S could be observed while functioning in his customary milieu. Children's regular classrooms were used for observation of classroom attention. Tasks used in individual testing were administered in an empty classroom with the door remaining open during the entire testing session so that auditory stimuli from hallways and corridors would be similar to that found in the usual school setting for such children.

Each S received a series of tasks, administered on an individual basis, under two different auditory conditions, i.e., the condition of normal auditory environment and the condition of reduced auditory input. The condition of reduced auditory input was established by placing a set of ear protectors on S and allowing him to proceed with his usual routine. Ear protectors are designed to block out a certain amount of auditory stimuli. They consist of a muff-type protection for the ears, which is attached to an adjustable vinyl headband. Attenuation data for the ear protectors used in the present investigation can be found in Figure 1. Previous pilot work had shown that children could hear and understand task instructions while wearing ear protectors so that pantomime or other unusual techniques were not required during the testing session. The condition of normal auditory input was established by the use of a placebo device that was somewhat similar in appearance to the ear protectors but that did not block out auditory stimuli.

A counter-balancing procedure was introduced concerning the order in which the auditory conditions were presented so that approximately one-half of all Ss were tested first under placebo conditions and the remaining Ss were tested first under ear protector conditions. There was an interval of one week between the two testing sessions.

The auditory devices described above were introduced to Ss by E in whatever

manner seemed most appropriate for the particular S involved. Some Ss were quickly amenable to wearing the equipment; others became amenable only after much effort and patience on the part of E. Whatever procedure was used in offering S the first device, the same procedure was repeated when offering S the remaining device one week later. Ss wore the auditory devices for approximately 45 minutes before the actual testing occurred and during the entire testing session.

Teacher Rating Scale

After each S wore the auditory device in the classroom for approximately 45 minutes, and before actual testing began, the teacher was handed a rating card with the following statement printed on it:
"We are interested in the amount of attention _____ has paid to the teacher and to classroom work during the past 45 minutes. Please rate _____ on the scale below." Teacher ratings were scored as: 0 for as attentive as usual, +1 and +2 for somewhat more attentive and considerably more attentive than usual, and -1 and -2 for somewhat less attentive and considerably less attentive. When two teachers were in the classroom during the time period that a particular S was wearing the equipment, each teacher was asked to rate, independently, the S in question. After E obtained completed rating cards from the teachers, S and E went to the room established as a testing room and the selected series of tasks was then administered.

Task Selection, Administration and Scoring

Tasks administered in this study included a pegboard task; a sorting task, involving the appropriate sorting of 50 blue and 50 white plastic poker chips into two different boxes; a cancellation task, involving the marking of a target animal wherever it appeared in a series of pages; an echo drum task,

involving a series of trials, each requiring the tapping repetition on a plastic drum of the exact number of taps performed by E; and a story task, requiring S to listen to a story and then select, from groups of three pictures each, the picture that was most appropriate for that particular story.

The pegboard and the sorting tasks were administered in exactly the same manner under the two different auditory conditions. The cancellation task requested the marking of a different target animal for each testing session; the echo drum task included a different series of tapping patterns for E to perform at each testing session; and the story task presented a different story, followed by different pictures of appropriate or inappropriate objects from which S was to choose, at each of the two testing sessions.

A detailed description of the administration and scoring procedures for each of the tasks described above can be found in the Appendix.

Rating of Task Attention

In addition to an actual score for task performance, Ss were rated by E for the amount of attention given to each task. An attention rating scale was established because pilot work had suggested that a seriously disturbed, communication-impaired, "autistic"-type child might attend to a task for a longer period of time while wearing ear protectors than in a normal auditory environment, even though this increase in attention would not necessarily be reflected in a higher performance score. The following attention scale was established in regard to the first four tasks administered in this study:

1. No attention given to the task. S appears unaware of the testing situation and does not look at or note the task in any way at all;

2. S shows some attention to the task but attends and/or performs in only a slight and transitory manner;

3. S gives considerable attention to the task during the testing time established for that particular task and shows evidence of some attempt at performance.

For the fifth task, the story task, the rating scale described above was applied only to the questioning period and the selection of appropriate pictures relevant to the story after the story had been read, since it was extremely difficult to judge correctly whether or not a child had been "attending" to the task during the actual story reading time.

During analysis of the data, it became apparent that a fourth category should have been added to each scale to provide more "top," since task attention was sometimes higher than was expected for such Ss.

Summary of Measures Obtained

In summarizing the above procedures, it should be noted that there were three different kinds of measures obtained in this investigation in regard to each S, i.e., a rating from each teacher concerning S attention level under the two different auditory conditions in the classroom,a rating from E as to the amount of attention given by each S to each task under the two auditory conditions, and, finally, an actual score indicating each S's performance on each task under the two auditory conditions. Each of the three measures provided information relevant to one of the three hypotheses being considered in this investigation.

RESULTS

Reliability of Teacher Ratings

Under placebo conditions, 18 Ss were rated for classroom attention by two

teachers each. Ratings for 16 of these Ss (approximately 89%) were in complete agreement. Under ear protector conditions, 17 Ss were rated by two teachers each. Ratings for 12 of these Ss (approximately 71%) were in complete agreement. For only one S was there a deviation of more than one point in regard to ratings from two different teachers.

Changes in Classroom Attention

While wearing the placebo device in the classroom, two Ss improved in classroom attention, as rated by their teachers, and two became less attentive. In terms of teacher ratings, the remaining 16 Ss showed no change. Accordingly, there was no evidence of a significant change in attention while Ss wore the placebo mechanism.

In contrast, while wearing ear protectors in their customary classroom settings, 11 of the 20 Ss were rated as being more attentive. None was rated as being less attentive. Such results are significant beyond the .01 level using the Sign Test[2] and offer support for Hypothesis I.

Improvement, according to teacher ratings, under ear protector conditions, was unrelated to order effect, i.e., the initial use of a device (either ear protectors or placebo) did not systematically result in higher teacher ratings of classroom attention.

Changes in Task Attention

Statistical tests of task attention, including tests for possible change and tests for order effect, were performed using the Wilcoxon Matched-Pairs Signed-Ranks Test.

Combining attention scores for all five tests, so that such scores ranged

from a minimum of five points to a maximum of 15 points, it was found that wearing ear protectors produced a significant improvement in attention ($p < .01$) as compared to the normal auditory-placebo condition. No order effect was found for such combined attention scores.

In examining the attention ratings for separate tasks, it was noted that ratings for one particular task, i.e., the sorting task, did not contribute to the improvement noted above. It should be noted that nearly all Ss appeared to enjoy handling the poker chips, occasionally dropping them by random handfuls into the available boxes. Accordingly, almost all Ss gave an impression of prolonged and considerable attention during the administration of this task, under both auditory conditions, even though such attention was often directed to the poker chips per se rather than to the specific task procedure. This may, in part, explain why attention ratings for this task did not contribute to the overall improvement exhibited under ear protector conditions.

Because the pegboard, sorting, and cancellation tasks were primarily visual, it had been previously decided to study the attention ratings for these three tasks combined (such ratings ranging from a minimum score of three to a maximum score of nine). Again, there was no evidence of an order effect. Results for combined ratings for visual tasks showed a significant change in task attention while Ss wore ear protectors as compared to attention ratings while wearing the placebo mechanism ($p < .05$). All changes were in the direction of improvement in task attention while wearing ear protectors. Again, it should be noted that attention ratings for the sorting task did not contribute to this significant improvement.

Attention ratings for the echo drum task, a task heavily loaded with auditory as well as visual skills, also showed significant change ($p < .05$)

under ear protector as compared to the placebo condition. Five of the 20 Ss showed higher attention ratings under the ear protector condition. No Ss showed lower attention ratings under ear protector conditions. No order effect was found for the echo drum task.

In contrast to attention ratings for a combination of predominantly visual tasks and attention ratings for a task which appeared to involve brief spurts of visual and/or auditory skills, i.e., the echo drum task, an examination of attention ratings for the story task produced somewhat different results. While most changes in attention ratings for the story task were in favor of the ear protector condition, such changes did not reach significance. This task, although involving some visual skills, was predominantly based on auditory skills and, in fact, involved the longest period of continuous auditory attention in the entire investigation. Although attention ratings for the story task were based on the child's attention during the actual questioning period after the story had been read, such attention may have been closely related to the child's attention during the reading of the story itself. Accordingly, lapses of attention or loss of interest during the story reading time (approximately two minutes for each story) may have contributed to the lack of change in attention ratings for this task.

In summary, it appeared that wearing ear protectors significantly increased the task attention ratings of seriously disturbed, communication-impaired, "autistic"- type children for a combination of all tasks and, separately, for some, but not all tasks administered in this investigation. The various increases in task attention noted above offer partial support for Hypothesis II. Distributive information concerning attention ratings can be found in Table 2.

Changes in Performance

For descriptive purposes, Table 3 shows the means and standard deviations of the actual scores achieved under the two auditory conditions for each of the five tasks in this investigation. In considering possible changes in performance, the absence of an order effect was first established individually for each task by means of the Wilcoxon Matched-Pairs Signed-Ranks Test.

Subsequently, in order to test the significance of possible changes in task performance, difference scores were found for each S, and a t test was then used to determine if the means of the difference scores for each test were significantly different from zero. Difference score equals score achieved under reduced auditory input minus score achieved under normal auditory input. These results are reported in Table 4. Because of the possibility that the t tests may, for some tasks, have been based upon distributions that did not completely fit the assumptions necessary for t tests, nonparametric tests were also performed on the data with essentially similar results.

A significant improvement in performance in the pegboard and cancellation tasks was found. In contrast, no significant change in performance was evidenced in the echo drum, story, or sorting task. As mentioned earlier, there was a significant increase in attention for the echo drum task. It should be noted that Ss seemed to enjoy the drum beating and often perseverated in their own drumming during the administration of this task instead of repeating the exact number of beats performed by E. This perseveration and prolonged drum beating, even when considerable attention was given to the task, may well have contributed to the resulting combination of low performance scores in spite of the high task attention exhibited under ear protector conditions.

Scores for task performance on the five different tasks were not combined in any way, as were attention scores, since performance points could not be appropriately combined across tasks without converting to standard scores, and the data did not lend themselves to such conversion.

The findings reported above offer conflicting evidence regarding the third hypothesis in this investigation in that task performance was significantly improved under ear protector conditions on two tasks involved, i.e., the pegboard and the cancellation tasks, and no improvement was found in performance on the remaining three tasks.

Supplementary Analysis

In further examination of the data, two possible tendencies were noted which suggest hypotheses that might be worthy of investigation, i.e., boys seemed to improve in task performance under ear protector conditions slightly more than did girls, and younger children seemed to show somewhat greater improvement in performance under ear protector conditions than did older children. Additionally, it is noteworthy that of the 15 children in the two lower communication levels, 10 received teacher ratings indicating an improvement in classroom attention under ear protector conditions while only one of the five children in the two higher communication levels showed such improvement. Although such numbers are too small to indicate a trend, they do raise the possibility that, among children of the type being studied in this investigation, those at the very lowest communication levels may be the ones who would most benefit, with respect to classroom attention, from a period of reduced auditory input.

DISCUSSION

In considering the findings of this study, it seems probable that the

increases in classroom attention and task attention and the changes in certain task performance reported in this investigation were due to a lessening of distracting sounds. However, it is possible that such changes may also have resulted, very simply, from reactions centered around the uniqueness of the ear protectors as compared to the placebo device. It must be recognized that Ss, as well as teachers, were likely to realize that the placebo did not alter sound input. Future research, in which Ss, teachers, and experimenters cannot differentiate between the ear protectors and the placebo device, would be needed in order to determine more exactly the specific causes of any observable changes in performance or behavior under ear protector conditions.

Additionally, the spontaneous comments of teachers, added to the completed rating cards, concerning some interesting behavioral effects of the ear protectors used in this study, merit some consideration. First, although teachers were asked to rate changes in attention, several teachers indicated a desire to note changes in behavior under ear protector conditions on numerous other variables. A number of teachers noted increases in calmness and reported that ear protectors appeared to have a soothing effect on certain Ss. Others noted a decrease in sudden noisy outbursts or in destructive or aggressive acts under ear protector conditions. Such changes were not always accompanied by increases in classroom attention, task attention, or task performance. It should be noted that no negative behavioral effects were reported while Ss wore the ear devices for the required time period with the exception of certain effects closely related to increases in calmness. For example, one previously agitated and highly distressed S became so much quieter under ear protector conditions that she resorted to withdrawal and regressive behavior, e.g., cradling her head in her arms, sighing, and thumb-sucking.

It is, of course, possible that some of these reported changes may eventually prove to be more meaningful in planning for the "autistic"-type child than the behavioral attributes being considered in the present investigation. Accordingly, the authors suggest that future research in this area might use an extended multi-dimensional rating scale so that teachers can evaluate possible changes in numerous attributes under ear protector conditions. Additionally, the careful investigation of the frequently reported increases in calmness under ear protector conditions, with emphasis on the possible value of such a potentially calming effect in psychotherapeutic and other situations as well as in the classroom, appears to be indicated. The authors also suggest consideration of possible beneficial effects on seriously disturbed children resulting from sound reduction in their classrooms by means of carpeting, drapes, furniture selection and placement, and even the positioning of the children in such classrooms.

Finally, it will be recalled that the supplementary examination of the data in this investigation raised the possibility that Ss with the most serious communication difficulties may have shown the greatest gains in attention under ear protector conditions. If confirmed, this might have implications for theory as well as practical applications such as the possible use of periods of decreased auditory input in speech therapy programs for certain seriously disturbed, communication-impaired children.

In conclusion, the present study suggests that reduced auditory input has a beneficial effect upon certain behaviors of a significant number of "autistic"-type children. Further study of this area seems warranted.

APPENDIX

Tasks administered in this study are described below.

Pegboard. This test consisted of one hardwood pegboard, 12" in length, 5" in width and 1" in height. The pegboard was placed on a table in front of S with a wicker basket containing 60 pegs placed to one side of the board, the particular side being determined by the handedness of the child if such handedness was determinable. After a demonstration period in which E placed three pegs in the board, S was instructed to place all of the remaining pegs in the pegboard. The three pegs originally placed by E were not removed, because pilot work had indicated that removal of these pegs simply encouraged Ss to imitate E by placing pegs in and taking them out of the board, rather than attempting to follow the verbalized directions. If S did not respond to the original instructions and demonstration, a repetition of such directions and a second demonstration was allowed. The score was the number of pegs correctly placed in 120" minus those originally placed by E. Total maximum score was 57 points.

Sorting Task. This task consisted of 50 blue and 50 white standard sized plastic poker chips; a blue box; a white box and a wicker basket. The blue and the white boxes were placed on a table in front of S, and a basket containing 100 mixed chips (50 blue and 50 white) was placed to one side of the boxes. After demonstration by E, S was asked to place all the blue chips in the blue box and all the white chips in the white box. The score for this task was the number of chips correctly placed in 120" minus the number of chips incorrectly placed and minus the two chips originally placed by E in demonstration. If there were more incorrect than correct placements, the score recorded was zero. An actual number score was recorded only if S was

making some attempt to separate the blue and the white chips. If S dropped the chips in the boxes by random handfuls, without making any attempt to separate blue and white chips, a number score was not recorded for such activity. The maximum possible score for this task was 98.

Cancellation Task. This task was a visual cancellation task. The test material consisted of six pages of line drawings of animal figures (bird, cat, cow, dog, horse, pig). Each page contained 36 pictures of such animals, arranged so that each animal appeared only once in each of six rows and only once in each of six columns. After demonstration by E, and a practice trial by S on a sample page, S was instructed to mark the "target animal" wherever it appeared on each of the six pages. Specifically, S was instructed, "Now put a mark on all the dogs on this page." Instructions were repeated as each page was turned. At the first testing session, the dog was the target item that was to be marked. At the second testing session, the cat was the target item that was to be marked. A pencil mark was made on the test material indicating the exact point that each S had reached during a 90" time period.

Because of occasional random scribbling, it was decided that only those cases in which S had appeared to aim at or to "zero in" on a particular figure would be counted. In scoring this task, a standard formula to correct for guessing or chance marking was used (Correct - Errors/N - 1). N was determined to be 6 since there were six different animals on each page, so that the formula became Correct - Errors/5. The maximum formula score possible for this task was 36.

Echo Drum. Equipment for this task consisted of one drumstick and two drums of molded plastic, each one being approximately 6" in diameter and 6"

in height. One drum was placed on the table in front of S and one drum was placed on the table in front of E. E told S, "I want you to tap your drum exactly like I tap mine." As a trial, E tapped three times on his drum, then handed the drumstick to S. S was now to tap three times. Three trials were allowed in which S was to repeat the exact number of taps performed by E. After three trials, a pattern was followed in which E tapped a certain number of times and then handed the drumstick to S. This procedure was followed for 12 trials, the number of taps ranging from one to four on each trial. S received one point for each trial in which he correctly repeated the exact number of taps performed by E. Total possible score for this task was 12 points. A pattern of taps, called pattern A, was ued at the first testing session and a different pattern of taps, called pattern B, was used as the second testing session. The task described as Echo Drum in this investigation has been based on a somewhat similar procedure, previously suggested by Hewett (1968), for use as a classroom attention-getting mechanism.

Story. Two stories, entitled "Little Red Hen" (story A) and "Rabbit's Mistake" (story B), were used for this task. Both stories were selected from Belling the Cat and Other stories, retold by Leland B. Jacobs, Golden Press, New York, 1969. In addition, 18 pictures were prepared by an artist and mounted individually on heavy cardboard. The pictures represented people, animals and objects which either related to the stories or else had no discernible relationship to the stories, according to a procedure suggested by Hauessermann (1958). Story A was read at the first testing session and story B was read at the second testing session. S was instructed to listen to the story and was told that, later, he would be asked some questions about the story. After the story had been read, S was presented with three pictures,

accompanied by the following instruction: "Here is a girl, a hen and a woman. Does the girl go with the story? Does the woman go with the story? Give me the picture that goes with the story." In order to score one point of credit, S had to select the appropriate picture. Following is a list of the pictures used with each story. In each case, the underlined object is the object which is correctly associated with the story: Story A--girl, hen, woman; truck, ball, bread; pig, turtle, horse; Story B--boy, rabbit, man; car, bell, nut; owl, fish, cow. S had to select the correct item from each group of three pictures, and only the correct item, in order to receive credit. If S selected two or three pictures on a particular trial, he received no credit for that trial, even if one of the items was a correct choice. Maximum possible score for each story was three points.

Table 1

Subject Characteristics

Age (years + months) (n = 20)		IQ[a] (n = 9)		Sex (n = 20)	Level of Expressive Communication (n = 20)		Amount of Echolalia Within Levels of Expressive Communication		
							None (n = 8)	Frequent (n = 8)	Predominant (n = 4)
Mean	8-2	Mean	54.33	M 14	0	No known communication by gesture or any other means.....	0	0	0
SD	1-10	SD	16.24	F 6					
Range	5-1 to 12-5	Range	30 to 76		1	Some attempt at communication but no meaningful verbal language.....	1	0	0
					14	Verbalization of single words and/or phrases only, not necessarily with any clear meaning.....	5	5	4
					2	Use of language to express needs only.....	2	0	0
					3	Use of language for cognitive purposes, but not necessarily in a consistent manner.....	0	3	0

[a]All children were judged by psychological examiners to be educable or higher, regardless of the score achieved on IQ examinations, since such scores were frequently judged to be questionable for the type of child being studied.

Table 2

Changes in Task Attention by Ss Showing Poor Attention

Under Either Ear Protector or Placebo Conditions

	N[a] showing poor task attention under either ear protector or placebo condition	Distribution of change[b] for each S who showed poor task attention under either condition							
		-2	-1	0	+1	+2			
Cancellation	5			1	3	1			
Pegboard	4				4				
Echo Drum	6			1	3	2			
Sorting	3		1	1	1				
Story Questions	8		2	1	3	2			
		-10...-1		0	+1	+2	+3	+4	+5	+6...+10
Total--All Tests Combined	13		2	7		2	1		1	

[a]IN THIS TABLE, N excludes those Ss who achieved the highest possible attention rating under both ear protector and placebo conditions and, accordingly, did not actually have an opportunity to achieve a change score in this attribute.

[b]Change equals task attention score achieved under ear protector conditions minus task attention score achieved under placebo conditions.

Table 3

Mean Scores and Standard Deviations of Tasks Administered to Seriously Disturbed, Communication-Impaired, "Autistic"-Type Children Under Normal Auditory Conditions and Under Conditions of Reduced Auditory Input

(n = 20)

	Normal Auditory Environment		Reduced Auditory Environment	
	Mean	SD	Mean	SD
Pegboard	22.85	16.45	29.10	14.10
Sorting	21.10	28.69	25.75	32.10
Cancellation	2.62	5.27	5.58	8.99
Echo Drum	2.60	3.69	2.70	3.90
Story	0.80	0.95	0.90	0.91

Table 4

Means, Standard Deviations and Tests of Significance for the Difference Scores[a] for Tasks Administered Under Two Different Auditory Conditions

(= 20)

	Mean	SD	t	p
Pegboard	6.25	12.58	2.22	<.05
Sorting	4.65	17.40	1.20	N.S.
Cancellation	2.96	4.90	2.69	<.05
Echo Drum	0.10	2.63	0.17	N.S.
Story	0.10	1.45	0.31	N.S.

[a]Difference scores equal score achieved under reduced auditory input minus score achieved under normal auditory input.

FOOTNOTES

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[2]This test, and all other statistical tests reported in this investigation, were two-tailed tests. Although the hypotheses are stated in a positive direction, it was acknowledged that change could be in either direction, and, accordingly, the more conservative test was used.

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